

Atlas V is launched with Advanced Extremely High Frequency satellite onboard



U.S. Air Force (Larry E. Reid, Jr.)

Spacepower and Warfare

By M . V . SMITH

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A discussion of the nexus of spacepower and warfare is controversial because space has yet to be overtly weaponized or generally recognized as an arena of open combat. Many, if not most, nations want to keep space a weapons-free peaceful sanctuary, particularly the suprastate actors. Just because all other media are weaponized and used as arenas of combat does *not* mean that space will automatically follow suit.¹ Perhaps this generation will figure out how to keep the beast of war in chains short enough to prevent it from going to space. But the next (and each succeeding) generation must also keep the chains short. Unfortunately, the constant march of technology is making space more important to states at the same time it is making it easier to build space weapons.

In anticipating the future of spacepower for theoretical discussion, we can do little

more than extract a roadmap from the history of human activity and extrapolate forward. The preponderance of evidence suggests that space will be no different from air, land, and sea regarding warfare. In the words of Colin Gray:

It is a rule in strategy, one derived empirically from the evidence of two and a half millennia, that anything of great strategic importance to one belligerent, for that reason has to be worth attacking by others. And the greater the importance, the greater has to be the incentive to damage, disable, capture, or destroy it. In the bluntest of statements: space warfare is a certainty in the future because the use of space in war has become vital. . . . Regardless of public sentimental or environmentally shaped attitudes towards space as the pristine final frontier, space warfare is coming.²

The strategic value of space to states is not in question. Advanced spacefaring states are already reliant—and moving toward dependence—on space-derived services for activities across every sector of their societies. Spacepower is becoming critical to their styles of warfighting. Likewise, the injury that can

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be caused to such states by menacing their space systems can be considerable. Given these incentives, the beast of war will either break its chains all at once or stretch them slowly over time.³

Like war itself, space warfare, the decision to build space weapons, and whether or not to weaponize space are all matters of policy, not theory.⁴ It is the job of theory to anticipate such developments given the template that history suggests. Land, air-, and seapower lend imperfect analogies to spacepower, but they are applicable enough to see that spacepower may have its own grammar, but not its own logic.⁵ The logic of statecraft and warfare laid out in Sun Tzu's *The Art of War* and in Carl von Clausewitz's *On War* applies to spacepower as well as any other element of military power. A student of spacepower must become thoroughly familiar with both of these works.⁶ War is a political activity and therefore a human activity with a long history that serves as a guide path. Spacepower is already part of the warfighting mix in the political and strategic unity of war, and this trend will continue.⁷ Some predict that spacepower will make the greatest contributions to combat effectiveness in wars of the 21st century.⁸

War Extended to Space

War is an instrument of policy, and spacepower, as an element of the military instrument of power, is part of the policy mix that makes war, whatever form it may take.⁹ Space generally has been treated as a sanctuary since the Eisenhower administration, and the use of space systems in warfare is limited to supporting terrestrial forces. This is not likely to change if the security concerns of states remain low. However, if states are confronted with intense security concerns, such as their survival, the weaponization of space and its use as an arena of conflict become far more likely.

Spacepower is a player at every point along the spectrum of conflict.¹⁰ Covert operations often use space services with the same degree of reliance as the large joint military forces of advanced spacefaring states engaged in a conflict. In addition, space systems often support multiple military operations with varying intensities in different parts of the world simultaneously.

Spacefaring prowess is a common attribute of the dominant powers in the world today. Special attention must be paid

to so-called rogue states that have access to space-related technology and may even be spacefaring but do not have the conventional forces to achieve their policy aims. Those aims tend to be very intense, and these players may

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seek space weapons as an asymmetric hedge against spacefaring adversaries who may try to coerce them.

The dominant military powers in the world, some of whom are potential adversaries, also tend to be the dominant spacefaring states. Because of the economic benefits and exponential enhancements that spacepower delivers to terrestrial warfighting, those states are under increasing pressure to defend their space systems and to counter those of their potential adversaries. This may lead to a space weapons race and an immediate escalation of hostilities to “wipe the skies” of enemy satellites should war break out between two or more dominant military space powers.¹¹

When assessing the interplay between the spectrum of conflict and the spectrum of belligerents, it may be the case that war between two weak actors will not likely extend into space. However, if the power is perceived to be disparate, a weak actor is far more likely to use space weapons against a powerful state as an asymmetric defensive move.¹² A powerful state may counter the space systems in use by a weaker adversary, but it is likely to do so by placing diplomatic pressure on commercial vendors, or executing attacks on their ground stations, or launching highly selective covert attacks on the satellites they use by employing temporary and reversible means.

Should two dominant spacefaring powers go directly to war with each other with intense motives, both will find it critical to preserve their space systems and will consider it a dangerous liability to allow their enemy to exploit them. Given the ability of spacepower to cut the fog and friction of war while connecting military forces at the tactical, operational, and strategic levels, it is likely that space systems will be primary targets that will be negated in the opening moves of war. The fight for space is likely to be intense and brief.

Temporary means of negation will probably switch to permanent methods of destruction to remove doubt in the minds of commanders.

Offense and Defense

Sun Tzu pointed out, “Invincibility lies in the defense; the possibility of victory in the attack. One defends when his strength is inadequate; he attacks when it is abundant.”¹³ All warfare depends on interplay between the offense and the defense. They are “neither mutually exclusive nor clearly distinct . . . each includes elements of the other.”¹⁴ Defense generally implies a negative aim of protection and of preserving the status quo in the face of an attack. Conversely, offense generally pursues a positive aim by inflicting damage on the adversary to coerce him into accepting terms. However, consider that there are defensive aspects resident in every attack. Warriors of old carried their shields into battle when they attacked with their swords to protect them from the thrusts of the defenders. The offense is also resident in every defense. Remember that the Royal Air Force won the great defensive Battle of Britain by attacking the invading German bombers.

The general goal of offense is to inflict such damage on the adversary that they are *defensively culminated*, meaning they can no longer resist the attack and must either accept terms or be annihilated. Conversely, the goal of defense is to resist the attack and inflict such costs on the adversary that they are *offensively culminated*, meaning they can no longer attack and can only defend themselves. These concepts will come into play when we discuss space control and space denial.

It is often said that defense is the stronger form of warfare.¹⁵ This is not true in space—today. Defending satellites and their data links is a difficult proposition at best. Satellites are delicate, fragile devices that can easily fall prey to any number of space weapons that currently exist, such as lasers, radio frequency jamming, brute force weapons, and surface-to-space missiles with kinetic kill vehicles—many of which are relatively small, mobile systems. While satellites in low Earth orbit are the most vulnerable to lasers and lofted kinetic kill vehicles, satellites all the way out in the geostationary belt and in highly elliptical orbits share a universal vulnerability to radio frequency jamming and electromagnetic brute force attacks. Satellites do not need to be physically destroyed to be rendered ineffective. Satellites are commanded

(as applicable) and provide their services to ground stations and users via the electromagnetic spectrum. Hence, there is a rule: no spectrum means no spacepower. The rapid proliferation of jammers and electronic intrusion devices around the world in recent years occurred upon recognition of this rule.

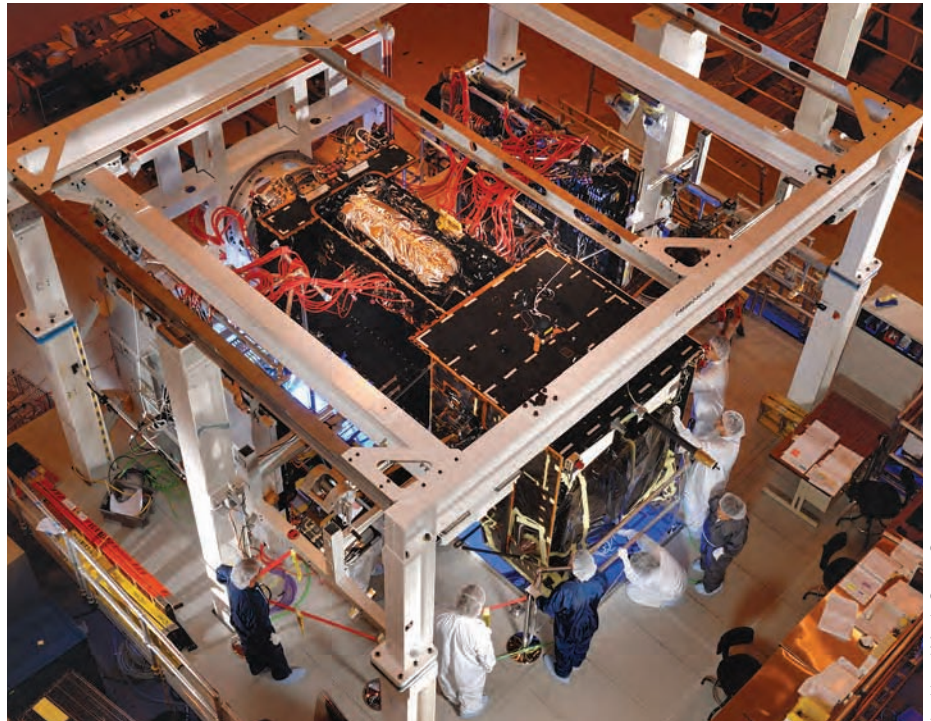
today's space defense rests on the assurances in the Outer Space Treaty, which imperfectly implies that space is a peaceful sanctuary, although it only bans the basing of weapons of mass destruction in space

Defenses to date are paltry at best. An adversary with robust space denial weapons may be able to negate all friendly space systems in a matter of hours; therefore, it is imperative for space powers to acquire the ability to find, fix, track, target, and destroy an adversary's space weapons very quickly. Such systems may reside on land, at sea, in the air, or in space. It will require close coordination with terrestrial forces to engage them against space weapons at the behest of the space commander.

In essence, today's space defense rests on the assurances in the Outer Space Treaty, which imperfectly implies that space is a peaceful sanctuary, although it only bans the basing of weapons of mass destruction in space. Does this mean all lesser threats are allowed? This is a hotly debated point. No one contests the language in article 51 of the United Nations charter that gives states the inherent right of self-defense. Presumably, this includes self-defense from space weapons and space-based weapons. It can be argued that space weapons are a matter of the inherent right of self-defense. The slope to space warfare is slippery indeed.

Although offense is the dominant form of war in space today, this will not always be the case. Defense is possible. Three principles will likely guide the development of future space defenses.

First, *if you can't see it, you can't hit it*. Satellites are already getting smaller—too small for most space surveillance networks to detect and track. This trend will likely continue not only as a matter of cost savings, but



Lockheed Martin Space Systems

Baseline integrated system testing of Space-based Infrared System geosynchronous orbit spacecraft

also as a matter of stealthy defense. Avoiding detection includes maneuvering satellites to undisclosed wartime orbits.

Second, *all warfare is based on deception*.¹⁶ Potential adversaries collect intelligence on each other's space systems and make their estimates based on their intelligence assessments. Action must be taken to deceive potential adversaries into underestimating the value of critical systems and overestimating the value of inconsequential systems. In addition, the use of wartime-only modes of operation, frequencies, and other unanticipated behaviors will further complicate an adversary's problems.

Third, *there is strength in numbers*. *The age of the capital satellites is over*. Employing only one or two large, very expensive satellites to fulfill a critical mission area, such as reconnaissance, is foolish. Future space systems must be large constellations of smaller, cheaper, and, in many cases, lower fidelity systems swarming in various orbits that exploit ground processing to derive high-fidelity solutions. In addition, swarms improve global access and presence.

The best defense for a space system in the 21st century may be the dual-use system that is owned, operated, and used by broad international partners. A hostile foe may be deterred from attacking a satellite if doing so comes with the likelihood of expanding the

war against their cause. This is also dependent on the hostile foe's policy aim. If it is intense, such as national survival or radical ideology, they may attack anyway.

The term *attack* is practically synonymous with *offense*, but it must be understood in a much more nuanced way regarding spacepower than is generally ascribed among those who hype the threat of direct kinetic kill antisatellite weapons that may smash satellites to bits. It must be remembered that space systems are comprised of space, ground, and user segments integrated through data links. Any of these segments or links can be targeted by an attack to gain the desired effect. A specific target within a space system is selected and a weapon is chosen to attack that target in a certain way to achieve the desired *level of negation*. The first includes temporary and reversible effects such as deception, disruption, and denial. The second includes permanent physical effects such as degradation and destruction. They can be described this way:

- *Deception* employs manipulation, distortion, or falsification of information to induce adversaries to react in a manner contrary to their interests.

- *Disruption* is the temporary impairment of some or all of a space system's capability to produce effects, usually without physical damage.



Modernization of U.S. Air Force Integrated Space Command and Control program will result in “virtual command center”

■ *Denial* is the temporary elimination of some or all of a space system's capability to produce effects, usually without physical damage.

■ *Degradation* is the permanent impairment of some or all of a space system's capability to produce effects, usually with physical damage.

■ *Destruction* is the permanent elimination of all of a space system's capabilities to produce effects, usually with physical damage (called *hard kill* or, without physical damage, *soft kill*).¹⁷

Ultimately, the level of negation is chosen to achieve the desired effect that serves the objectives given to space forces in support of the overall strategy and operational plans of the war. A very low-intensity war is likely to involve covert use of the temporary and reversible levels of negation. Conversely, more intense wars will probably tend toward the permanent levels.

There is a drawback to temporary levels of negation. It is exceptionally difficult to determine if the application of the weapon is achieving the desired effect. Permanent levels of negation may deliver more easily observable confirmation of effects. This is somewhat analogous to the problems of determining a tank kill in Operation *Desert Storm*. Some

commanders considered a tank killed if its unit was attacked and the tank was no longer moving. Others did not agree with this. But all agreed that it was a kill if the tank had its turret blown off.

It must be kept in mind that a small number of powerful directed energy space weapons can quickly cause permanent levels of negation to dozens of satellites. On the other hand, it would take several dozen space weapons such as jammers that only cause temporary effects to negate the constellations of the larger spacefaring states. Since noise jammers are only effective when broadcasting, and broadcasting jammers are relatively easy to find and target, there are incentives to develop space weapons that cause permanent effects.

If history serves as a template for the future in space, then space will become a warfighting medium. It is already heavily militarized, with powerful spacefaring states using the medium to enable their surveillance and reconnaissance strike complexes in ways that accelerate the scale, timing, and tempo of combat operations exponentially beyond non-spacefaring actors' ability to cope. Weak actors are likely to employ space weapons in an attempt to counter the advantage space confers on powerful states. The most dangerous situation, however, will occur if two powerful spacefaring states go to war with each other. If the

motives are intense, it is likely that they will be forced to counter each other's space systems in the very early stages. At present, there are inadequate defenses for space systems, but defense is possible. Space denial strategies of warfare are likely to evolve, wherein a belligerent merely attacks an adversary's space systems to inflict costs or to induce strategic paralysis on the enemy before offering terms. Finally, space is very much part of the military mix of all actors, state and nonstate, and it must be recognized that spacepower is not a replacement for terrestrial forces, but an additional set of tools that delivers unique capabilities. **JFQ**

NOTES

¹ Karl Mueller, "Totem and Taboo," *Astropolitics* 1, no. 1 (September 2003), 26–28.

² Colin S. Gray, *Another Bloody Century: Future Warfare* (London: Phoenix, 2006), 307.

³ It has been postulated that the weaponization of space will occur in one of two ways, based on either a single trigger event or a slippery slope. See Barry D. Watts, *The Military Uses of Space: A Diagnostic Assessment* (Washington, DC: Center for Strategic and Budgetary Assessments, February 2001), 98.

⁴ Carl von Clausewitz, *On War*, ed. and trans. Michael Howard and Peter Paret (Princeton: Princeton University Press, 1989), 87. Clausewitz's famous dictum that "war, therefore, is an act of policy" serves as a central proposition for *On War*.

⁵ Extrapolated from Clausewitz, 605.

⁶ Sun Tzu, *The Art of War*, trans. Ralph D. Sawyer (Boulder, CO: Westview Press, 1994); Clausewitz, previously cited.

⁷ Clausewitz, 605–607.

⁸ Colin S. Gray, *Modern Strategy* (Oxford: Oxford University Press, 1999), 256–257.

⁹ Clausewitz, 87.

¹⁰ Brian E. Fredriksson, "Space Power in Joint Operations: Evolving Concepts," *Air and Space Power Journal* (Summer 2004), available at <www.airpower.maxwell.af.mil/airchronicles/apj/apj04/sum04/fredriksson.html>.

¹¹ The urgency felt by powerful spacefaring states to "wipe the skies" is the thesis of a book by William B. Scott et al., *Space Wars: The First Six Hours of World War III* (New York: Forge, 2007), 7–16.

¹² Ibid.

¹³ Sun Tzu, *The Art of War*, trans. S.B. Griffith (New York: Oxford University Press, 1982), 85.

¹⁴ John Schmitt, *Warfighting: The U.S. Marine Corps Book of Strategy* (New York: Currency-Doubleday, 1995), 30.

¹⁵ Clausewitz, 84; Schmitt, 30.

¹⁶ Sun Tzu, *The Art of War*, ed. James Clavell, trans. Lionel Giles (New York: Delacorte Press, 1983), 11.

¹⁷ Air Force Doctrine Document 2–2, *Space Operations*, November 27, 2001, 13.